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The Work System Method: Systems Thinking for Business Professionals

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Abstract

The work system method (WSM) is a systems analysis method for thinking about systems in organizations whether or not complete data and technical expertise are available. WSM's goal is to help business professionals understand and communicate about a system at whatever level of detail is appropriate. WSM treats systems as sociotechnical work systems with human participants rather than technical systems with users. It applies a static view of systems, the work system framework, and a dynamic view, the work system life cycle model. It combines those frameworks with conventional problem solving by defining the system in relation to problems and opportunities, drilling down to understand the situation in more detail, and producing a justified recommendation. Over 600 employed MBA and Executive MBA students have used various versions of WSM to produce management briefings including recommendations about IT-reliant work systems in their own organizations. While WSM can stand alone to help business professionals, it also can be used in conjunction with tools and methods from Six Sigma and software development wherever sufficient data can be collected and where technical expertise is available.

Keywords: work system method, systems analysis, systems thinking, methods for business professionals

1. Systems Thinking Isn't just for Six Sigma Black Belts

Executives, managers, and other business professionals often need to understand and respond to problems and opportunities related to operational systems in their organizations. Such situations call for systems thinking, i.e., thinking about a situation as a system in order to make changes that do more than masking localized symptoms with quick fixes. Ideally, straightforward, easily used methods should be available to help them with that system thinking. Ideal characteristics of such methods differ from the characteristics of methods for technical experts that require formal model building, complex diagramming, statistical expertise, or extensive training in Six Sigma techniques or IT software design techniques. Characteristics of methods for typical business professionals include:

- The method should help them organize and explore their own understanding the situation as a step toward being able to communicate and negotiate about problems, opportunities, and possible directions for improvement.
- The method should be based on typical business terminology, not abstract concepts that few business professionals can use fluently.
- The method should emphasize problems, opportunities and issues (i.e., not just detailed documentation of system and data structure) because a business professional's need to think about systems is usually triggered by problems, opportunities, and issues.
- The method should recognize that business professionals often need to evaluate systems and make decisions whether or not potentially important data is actually available. Thus, while it is almost always better to have and use abundant, relevant, and carefully defined data, the method should not require extensive data or new data collection in order to launch a semi-formal analysis.
- The method should be usable in any order, implying that it cannot force a particular starting point.

- The method should recognize that systems thinking by business professionals occurs at different levels of depth, detail, and completeness because different business professionals, managers, and executives may have substantially different goals in relation to thinking about specific systems.
- While the method should be useable even when important information is unavailable, it should provide guidance concerning whether a specific analysis or design effort is balanced in its coverage of relevant content and whether it has relatively obvious omissions. This is consistent with the firm-level idea of the balanced scorecard [1].
- The method should be helpful in developing an organized understanding and communicating about it regardless of whether technical experts are available.

This paper discusses the work system method (WSM), a systems analysis method for business professionals that satisfies the above criteria. After providing general background about how WSM was developed, it summarizes the ideas in WSM, outlines a systems analysis template that has been used many times by employed MBA students producing management briefings, and discusses how WSM is related to Six Sigma and to methods for analysis and design of IT systems.

2. Background of the Work System Method

Over more than a decade, Alter developed a systems analysis method that can be used by business professionals for their own understanding and can support communication between business and IT professionals [2-9]. The research was motivated initially by experience in a manufacturing software firm and thinking about why its software seemed to have greater impact on performance for some customers. Additional motivation came from successive cohorts of generalist Executive MBA students who repeatedly confirmed that none of their firms had organized analysis methods that their managers and business professionals used routinely for thinking about systems and system improvement even if some firms seemed to have techniques for technical specialists.

WSM was designed to be usable for different purposes and at different levels of detail because the specifics of a situation determine the nature of the understanding and analysis that is required.

- An executive can use WSM at a highly summarized level to think about whether a system-related investment proposal is actually about improving a work system (not just software), and whether the comparison of the "as is" and "to be" work systems argues convincingly that performance will improve.
- A manager may simply want to ask questions to make sure someone else has done a thoughtful analysis. Or a manager may want to establish a personal understanding of a situation before discussing it.
- Implementers, change agents, and work system participants can use various aspects of the WSM to think about how the "as is" work system operates, how well it operates, and how and why possible changes might generate better results for the organization and for specific stakeholders.
- When collaborating with IT professionals, managers and other business professionals can use their understanding of a work system as a reference point for assuring that the IT professionals are fully aware of the business issues and goals that software improvements should address.
- IT professionals can use WSM for understanding system-related situations from a business viewpoint and for communicating more effectively with business professionals who are the customers for their work.

WSM was designed to support systems thinking at all of these levels. At an executive level, these questions boil down to visualizing a situation as a system whose performance matters and that can be improved. At the level of implementers, change agents, and work system participants the questions are about how possible changes in specific aspects of a work system may affect the work system's performance and the performance of related work systems.

3. Work System Basics

WSM assumes that the topic of analysis is a work system, a system in which human participants and/or machines perform processes and activities using information and technology to produce products and services for internal and/or external customers. Methods and tools that emphasize business viewpoints and issues should view such a system as a sociotechnical system and should focus on how to improve that system's performance. Almost all current work systems are IT-reliant. They rely on IT but are not IT systems. A work system's goal is to provide value for its customers, not just to operate consistent with its own specifications. Requirements are assumed to evolve over time. Information systems are special cases of work systems in which all of the processes and activities are devoted to processing information. Other important special cases of work systems include supply chains, self-service ecommerce systems, and projects. The concept of work system can be used to describe situations ranging

from the work of filling out simple computerized forms through the complex work of producing airplanes. The area of usefulness for WSM is between the two extremes.

The two central frameworks in work system method are the work system framework and work system life cycle model. The work system framework (Figure 1) identifies nine elements that are part of even a rudimentary understanding of a work system: customers, products and services, processes and activities, participants, information, technologies, environment, infrastructure, and strategies. The work system life cycle model (Figure 2) is an iterative model describing how work systems evolve through a combination of planned and unplanned change. The entity being analysed and improved is a work system, not an IT system. The life cycle view focuses on iterations of planned and unplanned change rather than on beginning to end steps in an IT project. (See [5-7] for details and clarifications.)

The default assumption that work systems have both social and technical elements does not imply that all work systems are sociotechnical, however. The default assumption allows for special cases in which systems are totally social (containing no important technical elements) or totally technical (containing no human participants). Allowing special cases makes it possible to decompose sociotechnical systems for purposes of analysis without worrying about whether a particular subsystem will be totally social or totally technical. It also fits with many current trends in business and society, such as the automation and commoditization [10] of many processes. In relation to reconciling the social and technical, this says that significant parts of systems with social elements may be completely technical and vice versa.

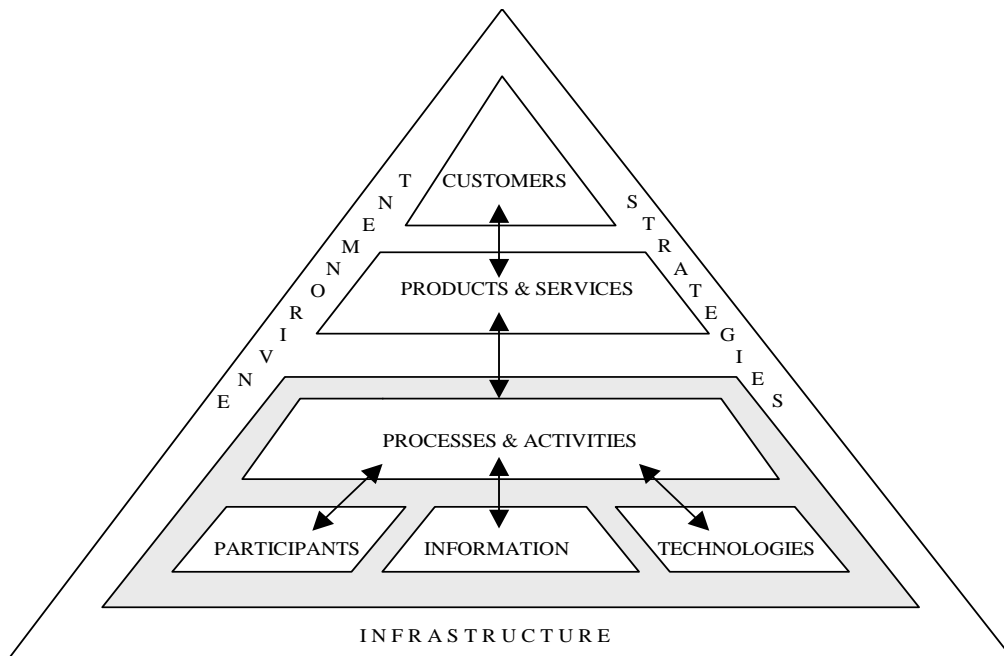


Figure 1. The Work System Framework

3.1 Work System Framework

The nine elements of the work system framework provide a basis for describing and analyzing an IT-reliant work system in an organization. The framework outlines components of a basically static view of a work system in which small details might change incrementally over time, but without changing the work system's overall structure, identity, or integrity. That type of view summarizes a work system's form and function at a point in time and is designed to emphasize business rather than IT concerns. It covers situations that might or might not have a tightly defined business process and might or might not be IT-intensive. Figure 1 is inherently service-oriented because it says that work systems exist to produce products and services for customers. The arrows say that the elements of a work system should be in alignment. The elements of the work system framework can be summarized as follows:

Customers are recipients of a work system's products and services for purposes other than performing provider activities within the work system. Since work systems exist to produce products and services for their customers, an analysis of a work system should consider who the customers are, what they want, and how they use whatever the work system produces. External customers are work system customers who are the firm's customers, whereas internal customers are work system customers who are employed by the firm, such as customers of the firm's payroll work system. Customers of a work system may also be participants in the work system (e.g., patients in a medical exam, students in an educational setting, and clients in a consulting engagement).

Products and services are the outputs of work systems, which exist in order to produce those outputs for their customers. Ignoring what a work system produces is tantamount to ignoring its effectiveness. Products and services consist of information, physical things, and/or actions produced by a work system for the benefit and use of its customers. The controversial distinction between products and services in marketing and service science is not important for WSM even though product-like vs. service-like is the basis of a series of valuable design dimensions for designing the things that a work system produces ([9], pp. 206-207).

Processes and activities occur within a work system to produce products and services for its customers. A work system must contain at least one activity. Otherwise it does not do anything. Many important work systems perform organized activities that may not be structured enough to qualify as a process by some definitions because the sequence of work relies heavily on human judgment and improvisation (e.g., [11, 12]). Use of the term "processes and activities" recognizes that the work being performed may or may not be a formal process with clearly specified set of steps whose beginning, sequential flow, and end are well-defined.

Participants are people who perform work within the work system, including both users and non-users of IT. Failure to include participants in an analysis automatically would omit important sources of variation in the results. Inclusion of the term *participant* instead of the term *user* avoids ignoring important participants who do not use computers and minimizes confusion due to referring to stakeholders as users, whether or not they actually use key technologies in a work system that is being analyzed. Customers are often participants in work systems, especially in work systems that are viewed as service systems.

Information is used or created by all work systems. In the context of work system analysis, information is expressed as informational entities that are used, created, captured, transmitted, stored, retrieved, manipulated, updated, displayed, and/or deleted by processes and activities. Typical informational entities include orders, invoices, warranties, schedules, income statements, reservations, medical histories, resumes, job descriptions, and job offers. Informational entities may contain other informational entities. For example, an order may contain a line item and a document may contain a chapter. The distinction between data and information is not important for understanding a work system since the only information that is mentioned is information that is used or processed by the work system.

Technologies are essential components of almost all current work systems. Technologies include both tools that are used by work system participants and automated agents, hardware/software configurations that perform totally automated activities. That distinction is crucial as work systems are decomposed into successively smaller subsystems, some of which are totally automated.

Environment includes the relevant organizational, cultural, competitive, technical, regulatory, and demographic environment within which the work system operates, and that affects the work system's effectiveness and efficiency. Organizational aspects of the environment include stakeholders, policies and procedures, and organizational history and politics, all of which are relevant to the analysis and design of many work systems. Factors in a work system's environment may have direct or indirect impacts on its performance results, aspiration levels, goals, and requirements for change. Analysis and design efforts that ignore important factors in the environment may overlook issues that degrade work system performance or even cause system failure.

Infrastructure includes relevant human, information, and technical resources that are used by the work system but are managed outside of it and are shared with other work systems. Infrastructure can be subdivided into informational infrastructure, technical infrastructure, and human infrastructure, all of which can be essential to a work system's operation and therefore should be considered in any analysis of a work system.

Strategies that are relevant to a work system include enterprise strategy, organization strategy, and work system strategy. Strategies at the three levels should be in alignment, and work system strategies should support organization and enterprise strategies. Unfortunately, strategies at any of the three levels may not be articulated or may be inconsistent with reality or with beliefs and understandings of important stakeholders.

3.2 Work System Life Cycle Model

As shown in Figure 2, the work system life cycle model (WSLC) expresses a dynamic view of how work systems change over time through iterations involving planned and unplanned (emergent) change. [5-7]. The WSLC differs fundamentally from the “system development life cycle” (SDLC) and other life cycle models related to software development. For example, the SDLC is basically a project model rather than a system life cycle. Some current versions of the SDLC contain iterations, but even those are basically iterations within a project. Second, the system in the SDLC is a basically a technical artifact that is being programmed. In contrast, “the system” in the WSLC is a work system that evolves over time through multiple iterations. In contrast with control-oriented versions of the SDLC, the WSLC treats unplanned or emergent changes as part of a work system’s natural evolution.

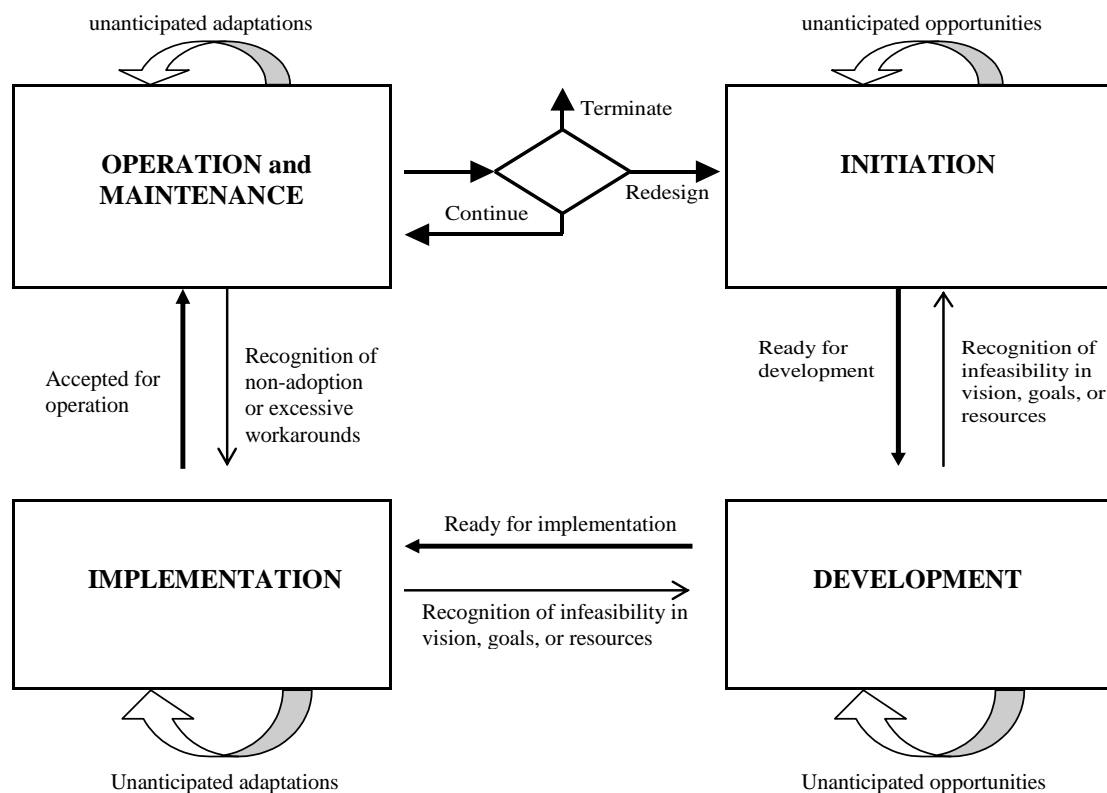


Figure 2. The Work System Life Cycle Model

Planned change. The WSLC represents planned change as projects that include initiation, development, and implementation phases. Development involves creation or acquisition of resources required for implementation of desired changes in the organization. Development may include any of the following: software development, software acquisition, software configuration, creation of new procedures, creation of documentation and training materials, and acquisition of any other resources needed for implementation of the new version of the work system. In contrast with the view of implementation in most software development methods, implementation in the WSLC means implementation in the organization, not implementation of software on computers. ([13] uses the terms development and implementation in a similar way.)

Unplanned (emergent) change. The WSLC represents unplanned change using inward-facing arrows that represent ongoing adaptations, workarounds, and experimentation that change aspects of the current work system without separate allocation of significant project resources. The inward facing arrows for all four phases of the WSLC

emphasize that emergent change occurs not only through incremental changes in operational systems, but also through changes that occur within different phases of formal projects. The inward-facing arrow for the operation and maintenance phase combines short term adaptations and workarounds of cumbersome processes and longer term changes in practices or goals that occur as adaptations and workarounds become routinized (e.g., [14]) without requiring formal projects. Emergence during the initiation phase of the WSLC may lead to goals that were not initially anticipated; emergence during the development phase may lead to new understandings and new combinations of functions and issues that were not anticipated in the initiation phase; emergence during the implementation phase may lead to modifications of the initial intentions concerning important aspects of the "to be" work system, including process and activity patterns, uses of technology and information, and expectations related to individual responsibilities and action by participants.

4. The Work System Method

WSM has evolved over more than 15 years. The most complete (but not most recent) summary of WSM [5] divides it into three main steps that apply general problem solving to systems in organizations. Those three steps are: system and opportunity (SO), analysis and possibilities (AP), and recommendation and justification (RJ)

- SO - Identify the System and Opportunities: Identify the work system that has the opportunities (or problems) that launched the analysis. The size and scope of the work system depends on the purpose of the analysis.
- AP - Analyze the system and identify Possibilities: Understand current issues and find possibilities for improving the work system.
- RJ - Recommend and Justify changes: Specify proposed changes and justify and sanity-check the recommendation.

WSM is designed for use in varied situations requiring different levels of detail and depth depending on the user's particular situation.

- Level One: Be sure to remember the three main steps (SO, AP, and RJ) when thinking about a system in an organization.
- Level Two: Within each main step, look at specific questions that are typically important.
- Level Three: Drill down further to consider specific guidelines and concepts that are useful in certain situations.

Table 1 illustrates WSM's structure by showing how the Level One summary of each of the three steps expands into more detailed questions at Level Two. The most basic Level One application of WSM encourages the user to think about the situation in work system terms. It provides minimal guidance other than saying that each of the three main steps (SO, AP, and RJ) should be considered. For example, assume that several people are speaking in general about the purported features and benefits of a CRM (customer relationship management) software package. Level One of WSM would encourage them to focus not on the software but on the work system(s) that is being addressed, on the work system's problems and opportunities, on possibilities for improving the work system to address these problems or opportunities, and on whatever changes in the work system should be recommended. Merely using these questions to stay focused on the work system instead of plunging into software details and features probably would make the initial discussion more productive and more directly related to whether the CRM addresses real business problems and opportunities in this setting.

Each question in Level Two is relevant when analyzing almost any system in an organization. Level Two can be used as a checklist to organize one's own analysis or to evaluate someone else's analysis to make sure that major aspects of a current and proposed system are considered. It can be used to make sure that an analysis has not over-emphasized one facet of a work system while ignoring other important facets. If any Level Two question has not been considered, the analysis is probably incomplete and may overlook important issues that are easily identified.

The "SO" questions in Level Two help in defining the work system's scope, which is not known in advance, but rather, depends on the opportunities or problems that are being pursued. To expedite the analysis effort and focus the recommendations, the work system should be the smallest work system that has the opportunity or problem. Defining the work system and opportunity or problem together reduces the likelihood of focusing the analysis on the purported features and benefits of a vendor's software rather than on the business situation. WSM users frequently mention their surprise at how much thought and effort is involved in identifying the system and the opportunity or problem. Even when there is initial agreement about the work system's scope, looking at the situation in more depth as the analysis unfolds often results in revising the initial assumptions about the work system's scope.

Table 1: First and Second Layers of Questions in the Work System Method as Defined in [5]

SO - Identify the <u>S</u> ystem and <u>O</u> pportunities: What work system are we talking about? From a business viewpoint, what are opportunities and problems in this work system?
SO1: What are the problems or opportunities?
SO2: What work system has these problems or opportunities?
SO3: What factors contribute to problems or opportunities?
SO4: What constraints limit the feasible range of recommendations?
SO5: Summarize the work system using a work system snapshot or a diagram.
AP - <u>A</u> nalyze the system and identify <u>P</u> ossibilities: What are the possibilities for improving this work system to address problems or opportunities related to each part of the work system?
AP1: Who are the customers and what are their concerns?
AP2: How good are the products and services produced by the work system?
AP3: How good are the work practices inside the work system?
AP4: How serious are any mismatches between the work system and the roles, knowledge, and interests of its participants?
AP5: How might better information or knowledge help?
AP6: How might better technology help?
AP7: How good is the work system's fit with its environment?
AP8: How well does the work system use the available infrastructure?
AP9: How appropriate is the work system's strategy?
AP10: How well does the work system operate as a whole?
RJ - <u>R</u> ecommend and <u>J</u> ustify changes: What changes in the work system do we recommend and how could we justify those changes?
RJ1: What are the recommended changes to the work system?
RJ2: How does the preferred alternative compare to other alternatives?
RJ3: How does the recommended system compare to an ideal system in this area?
RJ4: How well do the recommended changes address the original problems and opportunities?
RJ5: What new problems or costs might be caused by the recommended changes?
RJ6: How well does the proposed work system conform to work system principles?
RJ7: How can the recommendations be implemented?
RJ8: How might perspectives or interests of different stakeholders influence the project's success?
RJ9: Are the recommended changes justified in terms of costs, benefits, and risks?
RJ10: Which important assumptions within the analysis and justification are most questionable?

The "SO" questions in Level Two help in defining the work system's scope, which is not known in advance, but rather, depends on the opportunities or problems that are being pursued. To expedite the analysis effort and focus the recommendations, the work system should be the smallest work system that has the opportunity or problem. Defining the work system and problem or opportunity together reduces the likelihood of focusing the analysis on the purported features and benefits of a vendor's software rather than on the business situation. WSM users frequently mention their surprise at how much thought and effort is involved in identifying the system and the opportunity or problem. Even when there is initial agreement about the work system's scope, looking at the situation in more depth as the analysis unfolds often results in revising the initial assumptions about the work system's scope.

Although some of the "AP" questions in Level Two are more important than others in specific situations, inclusion of questions about all nine elements of the work system framework increases the likelihood that the analysis and design efforts will start with a reasonably balanced view of the work system and the range of possible improvements. In particular, this approach should overcome the common error of assuming that the system consists of little more than the software and computerized information.

The "RJ" questions at Level Two start by asking for a summary of the recommendation as a proposed "to be" work system. To increase the likelihood of finding pitfalls and inconsistencies, Level Two calls for identifying changes related to each of the nine elements of the work system framework, not just the software and hardware. The ten RJ questions stress different issues that could reveal oversights or problems related to the recommendation's economic or organizational practicality. A business professional using the RJ questions might be able to answer only a subset

of them. For example, it is rarely feasible to produce a cost-benefit justification without help from IT professionals who understand the technical issues and technical resources required. Nonetheless, the list can help in organizing an initial recommendation and justification, and can help in recognizing topics that need a deeper discussion and/or additional expertise.

WSM's Level Three provides guidance for looking at Level Two questions in more depth. The SO, AP, and RJ questions in Level Two (see Table 1) identify specific topics that are often worth considering for almost any system in an organization. In contrast, the Level Three topics are frequently important but might be unimportant in many specific situations. For example, Level Three topics related to the question AP3 (How good are the work practices inside the work system?) include: roles and division of labor, relevant functions not performed by the work system, problems built into the current business process or functions, effects of characteristics of processes and activities, evaluation criteria for processes and activities, problems involving phases of decision making, and problems involving communication. Each of these topics calls for looking more deeply at how work is done. Each brings a set of everyday concepts, images, and examples that may be useful. For instance, problems built into current business processes or functions might include any of the following: unnecessary hand-offs or authorizations, steps that don't add value, unnecessary constraints, low value variations, responsibility without authority, inadequate scheduling of work, large fluctuations in workload, and inadequate or excess capacity. Thus, Level Three provides a large number of topics that would be overwhelming if mentioned at the beginning of the analysis but that might be worthwhile to consider as the analysis unfolds in situations where they really matter.

5. Work System Analysis Template

Table 2 is an outline of a work system analysis template used in BSIS, MSIS, and MBA courses in the Fall of 2011. This template encompasses the topics in Levels One and Two of the version of WSM in Table 1, plus some Level Three topics. To hide surface complexity, it emphasizes four analysis steps and does not refer to the levels or to the abbreviations SO, AP, and RJ. To date, over 700 student papers using various versions of this template or previous work system analysis templates have been collected from courses in the United States, China, and Vietnam. The vast majority of those papers were produced by employed MBA or Executive MBA students doing a preliminary analysis of a work system in an organization that they or a team member worked in.

The template in Table 2 was designed to accomplish a dual pedagogical purpose. The effort of filling in the appendices provided experience in performing an organized, business-oriented analysis of a work system by defining the problem, summarizing the "as is" work system, looking at various aspects of the situation in more detail, and producing a justified recommendation about the "to be" work system. The effort of writing the management briefing reinforced the difference between performing the analysis and producing a management-oriented report related to the analysis and recommendation. The deliverable was a written management report (executive summary, background, etc.) based on the work system analysis template. An appendix contained a required set of tables plus other descriptive entries. As reported recently [15,16], the deliverables seemed to be equivalent to a midrange briefing that might be presented to a manager or a committee that would decide whether to put more effort into the analysis and how to allocate resources among various proposed projects. Given time limitations, participants were not expected to answer many of the questions in Table 1 or to provide level of detail required to produce a usable cost/benefit analysis.

The "work system snapshot" mentioned in Table 2 is a formatted one page summary of a work system in terms of the six central elements of the work system framework: customers, products and services, processes and activities, participants, information, technologies. [5-7, 9). The requirement of not exceeding one page helps focus attention on the scope of the system and avoids excessive detail in this high level summary under the assumption that subsequent analysis will reveal the details. Despite the textual nature of work system snapshots, they require rigorous thinking because of a series of internal consistency rules. For example, each of the processes and activities listed in the work system snapshot must be stated as a complete sentence that briefly specifies which participants perform the work and what they do. Each participant group must be involved in at least one step in the processes and activities. Each informational entity listed under information must be created or used in at least one step in the processes and activities. Each customer group must receive and use at least one product and/or service.

Table 2: Summary of a work system analysis template used in three courses in Fall 2011

Management Briefing (<i>Note: This was to be written after filling out the Appendices, thereby assuring that all major components would be considered in the analysis.</i>)	<ol style="list-style-type: none"> 1. Executive summary 2. Background 3. System and problem 4. Analysis and possibilities 5. Recommendation and justification
Appendix 1: Initial summary of the existing work system and the problem or opportunity	<ol style="list-style-type: none"> 1. Name of work system 2. Main problem or opportunity 3. Significance of the work system 4. Constraints that limit the possible recommendations 5. Performance gaps related to processes, participants, information, or technology 6. Performance gaps related to customer perceptions of products and services
Appendix 2: Summary of the current ("as is") work system and areas where customers perceive benefits from its operation and from its products/services.	<ol style="list-style-type: none"> 1. Work system snapshot of the "as is" work system 2. Customer value and customer concerns (for the primary customers) 3. Customer responsibilities (for the primary customers).
Appendix 3: Summary of problems, issues, opportunities in the current ("as is") work system	<ol style="list-style-type: none"> 1. Problems, issues, and opportunities for the system as a whole 2. Problems, issues, and opportunities for each step in the processes or activities in the work system snapshot 3. Problems, issues, and opportunities for specific work system elements (e.g., participants, information) 4. Problems, issues, and opportunities related to specific types of activities within the work system. (e.g., information processing, informing, communicating, social interaction, controlling work in order to achieve goals, decision making, and providing service.)
Appendix 4: Summary of the recommendations and their likely impacts	<ol style="list-style-type: none"> 1. Work system snapshot of the "to be" work system. 2. Likely impact of recommended changes for the system as a whole 3. Likely impact of recommended changes by step 4. Likely impact of changes related to specific types of activities

6. Discussion and Conclusions

WSM is a method that can support systems thinking by business and/or technical professionals in situations involving operational systems in organizations. It is designed to be used without requiring knowledge of statistics, diagramming tools, or other techniques that are mainly in the realm of technical experts. As stressed earlier, helping business professionals engage in a system-oriented analysis without using sophisticated tools and knowledge does not eliminate or minimize the need for advanced approaches in completing the analysis or making changes needed to improve performance. WSM calls repeatedly for clarification of problems and opportunities concerning different aspects of a work system and at least estimates of related measures of performance. A key benefit of using WSM is that it leads business professionals to identify areas where accurate measurement and detailed analysis of data are necessary.

WSM is consistent with much of the DMAIC process from Six Sigma. It calls for defining (D) the system of interest. It calls for measurement (M) of performance-related variables. A difference with DMAIC is that WSM recognizes that business professionals often need to make decisions even though full information will not be available before the decisions must be made. WSM outlines a generic analysis (A) process that can be adapted to any specific situation (e.g., Table 2). It calls for a recommendation concerning any desired changes from the "as is" to the "to be" work system. Where DMAIC subsumes the improvement (I) itself, the improvement is only suggested within WSM, consistent with the change management process summarized by the work system life cycle model (Figure 2). In real world situations where software development is required, creating the resources needed to achieve

the desired changes may take months. The controls (C) to make sure the improvements are maintained should be built into the management structure surrounding the "to be" work system.

WSM is designed to support genuine engagement of typical business professionals who otherwise might have difficulty pursuing an analysis independently for lack any organized method. It also supports engagement by avoiding requirements for statistical expertise and other sophisticated knowledge at the beginning of an analysis. Despite those general goals, nothing prevents the use of WSM in conjunction with commonly used Six Sigma and TQM techniques such as flow charts, swim-lane diagrams, control charts, Pareto diagrams, "5 whys," failure modes and effects analysis (FMEA), and so on. Use of WSM is also completely consistent with use of common tools for IT professionals, such as use case diagrams, data flow diagrams, entity-relationship diagrams, activity diagrams, and state chart diagrams. WSM provides a starting point, a means of communication, and a focus for negotiations. It does not try to replace valuable tools that experts use.

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